4.0 CAMERA UNIT SETUPS

In September 2001, site visits were made to the 19 photo-enforced intersections within the City of San Diego. These site visits were made to inspect and verify the operability and settings of the automated red light enforcement equipment (e.g. camera, camera unit, camera poles and housings, and loop detectors) used to detect red light violators at these intersections. The successful operation of camera enforcement is dependent on the reliable operation of the vehicle detection loops that trigger the first and second photographs for each violation and, if not properly configured and adjusted, may result in operational problems and questionable data. This section will describe the methodology used and results obtained from data collection.

4.1 METHODOLOGY FOR FIELD INSPECTIONS

Site visits to the 19 photo-enforced intersections were made over three days in late September 2001 (See Table 3). Prior to these site visits, all cameras had been turned off at the request of the San Diego Police Department on June 1, 2001. It was reported that they had not been checked during this period by maintenance staff.

A PBF representative inspected each red light camera unit at least once over this period. A second site visit was required for two intersections since equipment to test loop circuitry was unavailable at the time of the initial inspection.

Table 4-1
INSPECTION RECORD

Date of Inspection	Intersection
9/25/01	Aero Drive at Murphy Canyon Road
9/25/01 and 9/27/01	Carmel Mountain Road at Rancho Carmel Drive
9/25/01	Bernardo Center Drive at Rancho Bernardo Road
9/25/01	Mira Mesa Boulevard at Black Mountain Road
9/25/01	Miramar Road at Camino Ruiz
9/25/01 and 9/27/01	Towne Center Drive at La Jolla Village Drive
9/25/01	Mission Bay Drive at Garnet Avenue
9/25/01	Garnet Avenue at Ingram Street
9/26/01	Black Mountain Road at Gemini Avenue
9/26/01	“F” Street at 16th Street
9/26/01	10th Avenue at “A” Street
9/26/01	Garnett Avenue at Mission Boulevard
9/26/01	Mission Bay at Grand Avenue
9/26/01	Grape Street at Harbor Street
9/26/01	32nd Street at Harbor Drive
9/26/01	Imperial Avenue at Euclid Avenue
9/26/01	El Cajun at 43rd Street
9/27/01	College Avenue at Montezuma Road
9/27/01	Mira Mesa Boulevard at Scranton Road

During each site visit the PBF representative was accompanied by a representative from Lockheed Martin IMS/ACS. LM/ACS staff assisted with the provision of camera unit access and operation. The representative from LM/ACS was asked by the evaluator to perform a series of tasks needed to properly inspect and verify the operational status and settings of the camera unit, and other associated field equipment.

Data collection at each site focused on the camera pole and cabinet, camera unit, camera unit settings, auxiliary flash, and loop detectors. Among the more important data collected for each site were loop to loop pitch setting, which should match the loop center to loop center measurement (pitch) taken in the field; the minimum speed; and the interval distance, which is the distance that a violating vehicle will travel before the second photograph is taken. The minimum speed is the lowest speed at which the vehicle must travel to activate the camera. The interval distance is measured from the leading edge of the second loop to a position in the intersection which it has been determined will produce a second photograph showing the vehicle better than half way through the intersection. This distance is determined so that second photograph will provide the best possible view of the vehicle and driver. The interval distance is entered into the camera unit in meters. The verification of pitch, minimum speed, and interval distance along with a series of other checks on settings were performed through a process established between the PBF and LM/ACS representative.

4.2 DATA COLLECTION PROCEDURES

The procedures used to collect data at each intersection can be broken down into internal and external camera unit measurements. Internal camera measurements are those settings that were programmed into the camera unit prior to each intersection visit. External measurements, were those that were collected through visual inspection or tests conducted outside the camera unit (e.g. tests made at the terminal block and loop detector locations).

4.2.1 Internal Measurements

First, internal measurements were collected to determine if settings programmed into the camera unit match those that established by LM/ACS for the correct functioning of the camera system. These settings were available to PBF staff and were also reported on the data sheets located in each camera housing. Difference in settings that were programmed and those that were reported may identify the source of the problem, if a problem with the recording of violations were detected. Second, internal settings were reviewed to determine if the cameras were properly set to cite motorists.

Since internal measurements were programmed into the camera unit, the LM/ACS representative was called upon to assist in this effort. The LM/ACS representative provided access to the camera unit housing, and provided proof of settings programmed into the camera unit. Proof of settings was shown only after a series of steps were undertaken by the LM/ACS representative to activate the system.

To visually show programmed settings on the LCD display of the camera unit, the LM/ACS representative had to power up the system connect the plug for the detectors to the camera unit and calibrate the loop sensors before information programmed into the unit could be read. In most cases this process was completed effortlessly, in a few cases however, loop detectors failed to respond in a timely fashion and had to be removed, reattached to the camera unit and

recalibrated. Loop detectors, at several intersections failed to respond after several attempts were made to re-calibrate the loops. Intersections where loops failed to release i.e. be recognized as fully operational, were noted and attempts to solve the problem were briefly conducted by the LM/ACS representative. A more through analysis of calibration difficulties is provided in the results section.

At intersections where loops responded correctly, steps to visually observe the programmed settings were completed. The Lockheed representative moved through each of the programmed settings and information was obtained from the LCD display on the camera unit. Measurements that were collected and were deemed "internal" are provided below.

- Camera location code,
- Date and Time,
- Image capture delay,
- Loop to loop pitch,
- Detection location,
- Minimum detection speed,
- Interval, and
- Sleep/active days and times (capability for the camera to start and stop at specific times)

4.2.2 External Measurements

Similar to the internal measurements, external measurements of the camera unit were taken to determine if settings were proper and reported correctly. External measurements, however, were also conducted for associated red light enforcement equipment installed at each of the 19 intersections. Equipment, beside that of the camera unit, in which external measurements were made include; the camera pole and housing, loop detectors, camera, auxiliary flash, and intersection environment.

4.2.3 Camera Pole and Housing

The camera pole (See Figure 4-1) and housing (See Figure 4-2) were visually examined to determine the type and condition of the unit. In addition, the pole model was obtained from the LM/ACS representative.

Figure 4-1
CAMERA POLE AND HOUSING

Figure 4-2
CAMERA HOUSING

4.2.4 Camera Unit Information and Settings

The external information and settings on the camera unit were visually observed, verified and recorded. Information was obtained shortly after the camera unit housing was opened and before any alterations were made to the camera unit. Intervention of the LM/ACS representative was needed to obtain the camera lens information (e.g. aperture, focal length, and filters). In the process of obtaining this information, the camera unit installed within the camera unit was removed, and settings were shown to the PBF representative. The type of information that was recorded is provided below. The inside of the camera unit and camera are shown in Figure 4-3.

- Camera unit type,
- Camera unit model,
- Manufacturer property tag,
- Lockheed (USPT) property tag,
- Presence of filters and type,
- Lens focal length,
- Lens aperture,
- Flash power status, and Flash intensity

Figure 4-3
INSIDE VIEW OF CAMERA HOUSING SHOWING CAMERA UNIT

4.3 FIELD INSPECTION RESULTS

This section summarizes the findings of the field inspections conducted by the PBF project team.

4.3.1 Camera Pole and Cabinet

Three different camera poles (models 200, 300, and 400) were found at the 19 locations studied in this evaluation. Of these three models, the 200 model pole is the oldest and most frequently used model used at the 19 photo-enforced intersections. The model 200 pole is unique from the other two types of poles in the manner in which access to the camera housing is obtained. With the 200 model, the camera housing is lowered through a manual process whereas the lowering process for the other two models is automatic and similar to that of an elevator. The “elevator” poles (models 300 and 400) look and act similar to each other, with the 400 model being the most recently released model used in San Diego. Figures 4-4 and 4-5 show the position of the lowered camera housing for the hinged and elevator models respectively.

The camera pole and cabinet model are made out of steel, are painted, and are fully resistant to vandalism. The units are bolted onto a foundation located in the sidewalk or adjacent to the sidewalk and are generally located at least two feet and not more than a few feet from the edge of the roadway.

At each of the 19 camera locations, a considerable amount of dirt was found on the exterior surfaces of the camera pole and cabinet. At several of the locations, some rust formation and graffiti including stickers were also observed on the surface of the units. Besides the dirt and occasional rust, the camera pole and cabinets were in good physical condition. The conditions are recorded in Table 4-2.

Figure 4-4
LOWERED HINGED POLE

Figure 4-5
LOWERED ELEVATOR POLE

Camera unit identification data, including camera unit type and model, and both the manufacturer and USPT (now LM/ACS) serial tag numbers were collected and summarized in Table 4-3. From the data collected, it was determined that three different types of GATSO camera units are installed at the 19 photo-enforced intersections. The three camera unit models used were the 36mST-MC, 36mST-MC3P, and RLC-36 models.

The RLC-36 model is the most recently developed GATSO photo enforcement camera unit used in San Diego. The 36mST-MC and 36mST-MC3P camera units are similar with the main difference being the number of lanes each unit can be configured to enforce. The 36mST-MC3P model includes a third port that allows for a third lane to be monitored and enforced. The 36mST-MC3P model has only been deployed at the intersection of “F” Street and 16th Avenue. Although the camera unit at this intersection was able to enforce three lanes and loops for each

lane were installed, the camera unit was not configured properly to enforce red light compliance for the third lane.

A Robot 36DAT-P255761 camera was installed in 18 of 19 camera units inspected. At the time of inspection, the camera at the intersection of "F" Street and 16th Avenue was missing or not been installed. The cause of the missing camera is not known, but it is believed that vandalism or theft was not an issue. Since the camera at this intersection was missing, camera measurements were only reported for the 18 intersections with cameras installed.

The factory inspection records prepared by the camera unit manufacturer, GATSO, were obtained from LM/ACS and reviewed. These records indicated that all camera units had been fully tested and met the manufacturer's specification before being shipped from the Netherlands. The records indicated that the following functions had been tested under 110 VAC, 120 VAC and 100 VAC loads at high temperature high temperature +50°C and low temperature –10°C:

- Operational conditions, including time/date, times, counter status, and film transport operation;
- All adjustment functions;
- Supply red/yellow and check monitor and simulate offences;
- Check photo display (LED);
- Check detector; and
- Check flash functions.

The factory inspection tests provided for the verification of the following camera unit components and operations:

- Film transport;
- Camera;
- Automatic diaphragm control;
- Flash print;
- Detector;
- Monitor;
- Interface;
- Power supply 24-12 volt;
- Camera stop after 1 minute; and
- Up to three exposures per direction.

4.3.2 Internal Camera Unit Settings

Internal camera unit settings are summarized in Table 4-4. Not reported in the table are the date, time, sleep/active times, and detection location settings recorded during the site visit. For all locations, the date and time displayed on the LCD panel of the camera unit was accurate. All camera units were programmed to operate 24 hours a day/seven days a week, thus sleep/active time settings were disabled. Lastly, front detection was enabled for all units.

Two camera unit settings are of particular importance for the San Diego photo enforcement program, the pitch measurement and the delay time. These settings are reviewed in more detail in the following sections.

Table 4-2
POLE TYPE MODEL AND CONDITIONS

Intersection	Pole Type	Pole Model	Conditions
Aero Drive at Murphy Canyon Road	Hinged	200 Series	Rust Present
Carmel Mountain Road at Rancho Carmel Drive	Elevator	300 Series	A little Rust Present
Bernardo Center Drive at Rancho Bernardo Road	Hinged	200 Series	Dirty
Mira Mesa Boulevard at Black Mountain Road	Hinged	200 Series	A little rust and dirty
Miramar Road at Camino Ruiz	Elevator	300 Series	Needs paint touch up and has rust
Towne Center Drive at La Jolla Village Drive	Hinged	200 Series	Good
Mission Bay Drive at Garnet Avenue	Hinged	200 Series	Marked up and needs paint touch up
Garnet Avenue at Ingram Street	Hinged	200 Series	Graffiti in the form of stickers and dirty
Black Mountain Road at Gemini Avenue	Elevator	400 Series	Dirty
“F” Street at 16th Street	Hinged	200 Series	Needs paint touch up, has rust and is dirty
10th Avenue at “A” Street	Elevator	300 Series	Good
Garnett Avenue at Mission Boulevard	Elevator	400 Series	Marked up, has graffiti and is dirty
Mission Bay at Grand Avenue	Elevator	400 Series	Good
Grape Street at Harbor Street	Elevator	300 Series	Extremely dirty
32nd Street at Harbor Drive	Hinged	200 Series	Needs paint touch up and is dirty
Imperial Avenue at Euclid Avenue	Hinged	200 Series	Dirty
El Cajun at 43rd Street	Hinged	200 Series	Graffiti, dirty, and has a little rust
College Avenue at Montezuma Road	Hinged	200 Series	Graffiti and dirty
Mira Mesa Boulevard at Scranton Road	Elevator	400 Series	Dirty

Table 4-3
PHOTO ENFORCEMENT CAMERA TYPES AND IDENTIFICATION

Intersection	Camera Unit Type	Camera Unit Model	Manufacturer Tag Number	USPT Tag Number
Aero Drive at Murphy Canyon Road	GATSO	36mST-MC	957	E 0025
Carmel Mountain Road at Rancho Carmel Drive	GATSO	RLC-36	1100	E 0488
Bernardo Center Drive at Rancho Bernardo Road	GATSO	36mST-MC	856	00609
Mira Mesa Boulevard at Black Mountain Road	GATSO	RLC-36	1188	???
Miramar Road at Camino Ruiz	GATSO	RLC-36	1356	A 1123
Towne Center Drive at La Jolla Village Drive	GATSO	RLC-36	1186	E 0990
Mission Bay Drive at Garnet Avenue	GATSO	RLC-36	1066	E 0454
Garnet Avenue at Ingram Street	GATSO	36mST-MC	847	00889
Black Mountain Road at Gemini Avenue	GATSO	RLC-36	1064	E 0442
“F” Street at 16th Street	GATSO	36mST-MC3P	899	00912
10th Avenue at “A” Street	GATSO	RLC-36	1094	E 0509
Garnett Avenue at Mission Boulevard	GATSO	RLC-36	1101	E 0527
Mission Bay at Grand Avenue	GATSO	RLC-36	1357	A 1129
Grape Street at Harbor Street	GATSO	RLC-36	1105	E 0628
32nd Street at Harbor Drive	GATSO	RLC-36	1058	E 0448
Imperial Avenue at Euclid Avenue	GATSO	RLC-36	1102	E 0533
El Cajun at 43rd Street	GATSO	RLC-36	1057	E 0459
College Avenue at Montezuma Road	GATSO	RLC-36	1055	E 0436
Mira Mesa Boulevard at Scranton Road	GATSO	RLC-36	1359	A 1141

Table 4-4
INTERNAL CAMERA UNIT SETTINGS

Intersection	Camera Location Code	Date	Time	Delay	Interval	Pitch	Minimum Detection Speed
Aero Drive at Murphy Canyon Road	1422	Correct	Correct	0.4sec	22m	198cm	15mph
Carmel Mountain Road at Rancho Carmel Drive	1543	Correct	Correct	0.4sec	28m	203cm	12mph
Bernardo Center Drive at Rancho Bernardo Road	1414	Correct	Correct	0.4sec	20m	198cm	15mph
Mira Mesa Boulevard at Black Mountain Road	1492	Correct	Correct	0.4sec	27m	203cm	15mph
Miramar Road at Camino Ruiz	1534	Correct	Correct	0.4sec	21m	202cm	15mph
Towne Center Drive at La Jolla Village Drive	1474	Correct	Correct	0.4sec	18m	231cm	15mph
Mission Bay Drive at Garnet Avenue	1513	Correct	Correct	0.4sec	16m	228cm	15mph
Garnet Avenue at Ingram Street	1454	Correct	Correct	0.4sec	17m	204cm	15mph
Black Mountain Road at Gemini Avenue	1551	Correct	Correct	0.4sec	8m	202cm	12mph
"F" Street at 16th Street[1]	1504	Correct	Correct	0.4sec	14m	203cm	15mph
10th Avenue at "A" Street	1523	Correct	Correct	0.1sec	17m	205cm	12mph
Garnett Avenue at Mission Boulevard	1542	Correct	Correct	0.4sec	13m	203cm	12mph
Mission Bay at Grand Avenue	1541	Correct	Correct	0.4sec	33m	202cm	15mph
Grape Street at Harbor Street	1533	Correct	Correct	0.5sec	18m	203cm	12mph
32nd Street at Harbor Drive	1444	Correct	Correct	0.4sec	16m	227cm	15mph
Imperial Avenue at Euclid Avenue	1484	Correct	Correct	0.4sec	13m	228cm	15mph
El Cajun at 43rd Street	1404	Correct	Correct	0.4sec	11m	202cm	15mph
College Avenue at Montezuma Road	1462	Correct	Correct	0.4sec	21m	234cm	15mph
Mira Mesa Boulevard at Scranton Road	1553	Correct	Correct	0.4sec	14m	203cm	15mph

4.3.3 Camera Unit Pitch Settings

A key measurement for the Red Light Camera Program is the center-to-center distance between the loops in each lane, that is, the pitch measurement.

Table 4-5 provides a comparison of the measured pitch distances to the pitch values observed in the camera units at each intersection. The measurements are within close tolerances at all intersections. It would be useful if the abandoned loops were cut at right angles at two or more sides so that it is clear that the abandoned loops are not functioning.

Minor differences on the order of one percent or less in the pitch measurements may be disregarded. It is not possible to cut loops to tolerances where small differences in the loop-to-loop separation are present, depending on where the measurement is made. Where there is any uncertainty in the pitch measurements, a lower value should be used for the camera unit setting as this adjustment will provide motorists with a small “benefit of doubt” factor when speeds are being calculated.

Table 4-5
COMPARISON OF CAMERA SETUP PITCH SETTINGS AND FIELD MEASUREMENTS

Code	Location	Measured Camera Pitch (cm)	Camera Pitch Setting (cm)	Difference (c), (d), (e)
1404	WB El Cajon Boulevard at 43rd Street	201	202	+1
1444	WB Harbor Drive at 32nd Street	225/230 (a)	227	-2/+3
1454	WB Garnet Avenue at Ingraham Avenue	201	204	+3
1484	WB Imperial Avenue at Euclid Avenue	229	228	+1
1504	WB F Street at 16th Street	203	203	-
1523	EB A Street at 10th Avenue	204.5	205	+0.5
1534	WB Miramar Road at Camino Ruiz	202	202	-
1542	SB Mission Boulevard at Garnet Avenue	205	203	-2
1551	SB Black Mountain Road at Gemini Avenue	203	202	-1
1553	EB Mira Mesa Boulevard at Scranton Road	203	203	-
1414	NB Bernardo Center Drive to WB Rancho Bernardo Road	198	198	-
1422	WB Aero Drive to SB Murphy Canyon Road	199.5	198	+1.5
1462	SB College Avenue to EB Montezuma Road	230/235	234	-4/+1
1474	WB La Jolla Village Drive at Towne Center Drive	200/231 (b)	231	-31/-
1492	SB Black Mountain Road to Mira Mesa Boulevard	203	203	-
1513	EB Garnet Avenue to NB Mission Bay Drive	225	228	+3
1533	North SB Harbor Drive to EB Grape Street	203	203	-
1541	NB Mission Bay Drive to WB Grand Avenue	203	202	-1
1543	EB Carmel Mountain Road to NB Rancho Carmel Drive	203	203	-

NOTES: (a) Two sets of loops with different pitches are installed at these locations.
(b) Two sets of loops, only one of which is operational, are installed at these locations.
(c) Differences of less than one percent are not significant.
(d) Minus differences will result in vehicle speeds being calculated lower than actual speeds, in favor of the motorist.
(e) Plus differences will result in vehicle speeds being calculated higher than actual speeds, not in the favor of the motorist.

4.3.4 Camera Unit Delay Time Settings

The camera unit delay time settings are 0.4 seconds, except at one intersection where the delay time is set at 0.5 seconds and one intersection where the loops are situated on the upstream side of the stop line (A Street and 10th Street) and the delay time has been set at 0.1 seconds.

For most photo enforcement system installations, the delay time represents a “grace” period for motorists entering the intersection against a red traffic signal indication. For the San Diego intersections where the vehicle detection loops have been installed on the downstream side of the stop line, the delay time is not the length of the grace period and direct comparisons with delay time settings by other photo enforcement programs are not applicable. At the A Street and

10th Street intersection where the loops are located on the upstream side of the stop line, the delay time accurately reflects the grace period given to motorists before being photographed.

The actual grace periods being applied the 19 photo-enforced intersections, except for the A Street/10th Street intersection, varies according to vehicle speed and the distance of the leading edge of the second loop from the stop line. In other words, the grace period is not consistent from intersection to intersection nor, for the most part, from vehicle to vehicle. The actual grace times may be determined by examining the tables developed by LM/ACS for each intersection and used to determine whether a citation should be issued for each photographed violation. From an examination of these tables, the actual grace periods applied in issuing citations vary from 0.25 seconds to 0.57 seconds.

Table 4-6 summarizes the delay times, being applied as grace times for motorists, for selected photo enforcement programs.

Table 4-6
CAMERA UNIT DELAY TIME SETTINGS
FOR SELECTED PHOTO ENFORCEMENT PROGRAMS

Jurisdiction	Delay Time (Seconds)
Fairfax	0.4
Howard County	0.5
New York City	0.3
Howard County	0.5
Oxnard	0.4
San Francisco	0.3
San Diego	*0.1-0.55*

4.3.5 Camera Unit Minimum Speed Settings

Depending on the location, the red light cameras are programmed to capture violators exceeding minimum speeds of 12 or 15 mph. This minimum speed threshold appears to be similar but slightly lower than the minimum speed settings used by other photo enforcement programs as found in the literature. The lowest minimum speed setting reported for other photo enforcement programs was 15 mph, which is the highest speed used in San Diego. The highest minimum speed reported in the literature was 19 mph (see Table 4-7). The impact of using a lower minimum speed, such as 12 mph that is used at five out of the 19 photo-enforced intersections in San Diego, is that more violators will be cited than if a higher minimum speed was used. However, it should be remembered that the primary purpose of the minimum speed is to avoid the inclusion of stationary or near stationary vehicles in the intersection that are stuck for whatever reason. From the point of view of using the same rules for issuing citations at all locations, it may be argued that the use of the same minimum speed setting at all photo-enforced intersections is appropriate.

4.3.6 External Camera Unit Settings and Data

Settings for flash units and vehicle detector equipment that is external to the camera unit but inside the camera unit housing are summarized in Table 4-8. In all cases, the flash contained within the camera housing was deactivated but shown to work for all locations. The flash intensity was found to be set equally between the high and medium settings.

Table 4-7
CAMERA UNIT MINIMUM SPEED SETTINGS
FOR SELECTED PHOTO ENFORCEMENT PROGRAMS

Jurisdiction	Minimum Speed (mph)
Fairfax	15
Howard County	19
New York City	15
Howard County	19
Oxnard	15
San Francisco	15
San Diego	*12 or 15*

4.3.7 Camera Settings and Data

The camera at each location was removed from its respective camera unit and observed to determine the lens aperture and focal length. Typically, the lens aperture was either set at 75mm or 90mm, with the exception of the unit located at the intersection of Carmel Mountain Road and Rancho Carmel Drive where an aperture of 45mm was observed. The lens focal length was frequently found to be set at 20m, although this was not the case for all intersections. Excluding the camera unit with a missing camera, lens focal length data was not obtained for five intersections.

During the observation of camera settings, it was noted that polarizing filters were used on six units. Polarizing filters help reduce glare from the sun and light reflected off vehicle windshields. With reduced glare, the camera can more effectively capture the identity of the driver who had committed a red light violation.

Camera settings and filter information are summarized for each intersection in Table 4-9 on the second following page.

Table 4-8
EXTERNAL CAMERA UNIT SETTINGS AND DATA

	Flash Settings		Detector Settings[1]			
Intersection	Status	Power	Frequency	Sensitivity	Mode	Detectors Active for all lanes
Aero Drive at Murphy Canyon Road	Off	High	High	Low	Pulse	Yes
Carmel Mountain Road at Rancho Carmel Drive	Off	High	-	-	-	No
Bernardo Center Drive at Rancho Bernardo Road	Off	Medium	High	Low	Presence	Yes
Mira Mesa Boulevard at Black Mountain Road	Off	Medium	-	-	-	Yes
Miramar Road at Camino Ruiz	Off	High	-	-	-	Yes
Towne Center Drive at La Jolla Village Drive	Off	Medium	-	-	-	Yes
Mission Bay Drive at Garnet Avenue	Off	High	-	-	-	Yes
Garnet Avenue at Ingram Street	Off	High	High	Low	Presence	Yes
Black Mountain Road at Gemini Avenue	Off	High	-	-	-	No
“F” Street at 16th Street	Off	Medium	High	Low	Presence	Yes
10th Avenue at “A” Street	Off	High	-	-	-	Yes
Garnett Avenue at Mission Boulevard	Off	Medium	-	-	-	Yes
Mission Bay at Grand Avenue	Off	High	-	-	-	Yes
Grape Street at Harbor Street	Off	High	-	-	-	Yes
32nd Street at Harbor Drive	Off	High	-	-	-	Yes
Imperial Avenue at Euclid Avenue	Off	Medium	-	-	-	Yes
El Cajun at 43rd Street	Off	Medium	-	-	-	Yes
College Avenue at Montezuma Road	Off	Medium	-	-	-	Yes
Mira Mesa Boulevard at Scranton Road	Off	High	-	-	-	Yes

[1] The Frequency, Sensitivity, and Mode settings can only be manually set and observed for the Red Light Camera Model 36mST-MC. Detector settings were reported for these models only.

Table 4-9
CAMERA SETTINGS

Intersection	Lens Aperture	Lens Focal Length	Filters	Camera Activation
Aero Drive at Murphy Canyon Road	75mm	NA	Polarizer	Pass
Carmel Mountain Road at Rancho Carmel Drive	45mm	NA	-	Fail
Bernardo Center Drive at Rancho Bernardo Road	75mm	20m	-	Pass
Mira Mesa Boulevard at Black Mountain Road	90mm	NA	-	Pass
Miramar Road at Camino Ruiz	75mm	NA	-	Pass
Towne Center Drive at La Jolla Village Drive	90mm	NA	-	Fail
Mission Bay Drive at Garnet Avenue	75mm	20m	-	Pass
Garnet Avenue at Ingram Street	90mm	20m	Polarizer	Pass
Black Mountain Road at Gemini Avenue	75mm	20m	-	Fail
"F" Street at 16th Street[1]	NA	NA	NA	Fail
10th Avenue at "A" Street[2]	90mm	20+m	Polarizer	Pass
Garnett Avenue at Mission Boulevard	75mm	22m	Polarizer	Pass
Mission Bay at Grand Avenue	75mm	21m	Polarizer	Pass
Grape Street at Harbor Street	75mm	20m	-	Pass
32nd Street at Harbor Drive	90mm	20m	Polarizer	Pass
Imperial Avenue at Euclid Avenue	90mm	20m	-	Pass
El Cajun at 43rd Street	75mm	20m	-	Pass
College Avenue at Montezuma Road	75mm	20m	-	Pass
Mira Mesa Boulevard at Scranton Road	75mm	20m	-	Pass

4.3.8 Auxiliary Flash

An auxiliary flash(s) were installed at eight locations to help illuminate the interior cabin of the vehicle committing a red light violation (see Table 4-10). Auxiliary flashes were not installed at the other eleven intersections because either they were not needed or the intersection geometry prevented the installation of units at locations close enough to the intersection where the flash would be beneficial. In most instances, the EL 250 (250 indicates the flash's intensity in watts) model flash was used (see Figure 4-6). The exception would be the intersection of Aero Drive at Murphy Canyon Road where the EL 500 model flash was used (see Figure 4-7).

Figure 4-6
EL 250 AUXILIARY FLASH

Figure 4-7
EL 500 AUXILIARY FLASH

Table 4-10
AUXILIARY FLASH DATA

Intersection	Flash Type	Flash Power
Aero Drive at Murphy Canyon Road	EL 500	500 W
Carmel Mountain Road at Rancho Carmel Drive	EL 250	250 W
Bernardo Center Drive at Rancho Bernardo Road	-	-
Mira Mesa Boulevard at Black Mountain Road	-	-
Miramar Road at Camino Ruiz	EL 250	250 W
Towne Center Drive at La Jolla Village Drive	-	-
Mission Bay Drive at Garnet Avenue	-	-
Garnet Avenue at Ingram Street	-	-
Black Mountain Road at Gemini Avenue	EL 250	250 W
"F" Street at 16th Street[1]	-	-
10th Avenue at "A" Street[2]	EL 250	250 W
Garnett Avenue at Mission Boulevard	-	-
Mission Bay at Grand Avenue	EL 250	250 W
Grape Street at Harbor Street	EL 250	250 W
32nd Street at Harbor Drive	-	-
Imperial Avenue at Euclid Avenue	-	-
El Cajun at 43rd Street	-	-
College Avenue at Montezuma Road	-	-
Mira Mesa Boulevard at Scranton Road	EL 250	250 W

4.3.9 Camera and Detector Operations

Loop detectors are installed at each photo-enforced intersection to detect vehicles that commit a red light violation and enable the camera unit to take two pictures of the vehicle as it traverses the intersection. At all but one of the photo-enforced intersections ("A" Street at 10th Avenue), loop detectors were placed on the intersection side of the approach stop bar. If a stop bar is not present for a monitored intersection approach, the crosswalk striping was used. Each lane that is enforced has one pair of loop detectors.

Figure 4-8, illustrates the typical placement of loop detectors.

The loop detectors are used to determine the speed of vehicles as they cross over the detectors. Either a 12 mph or 15 mph minimum speed threshold is used as the basis for determining that a violation had occurred. In other words, motorists traversing the set of loop detectors at speeds lower that the minimum speed threshold against a red traffic signal are not recorded as violations.

Violations where the minimum speed threshold is not exceeded may occur by the intentional red light runner. There may be instances where a motorist may have a lengthy wait at a red light when there is little to no cross-traffic. In these situations, frustrated motorists may think that there is no apparent danger and will disregard the red light. These violations are likely to occur in the very early morning hours when traffic volumes are at their lowest.

Figure 4-8
TYPICAL LOOP ARRANGEMENT

The operation of the loop detectors was inspected at each of the photo-enforced intersections. First, the operation of the camera units in their "test" mode was observed to verify that vehicles crossing over the detector loops were actually triggered the camera unit to take photographs (this testing was completed without film in the camera). Second, each of the loop detector circuits was tested by measuring the leakage resistance or the electrical resistance between the detector circuit and earth ground. Test measurements were conducted at the camera pole terminal block, where each loop circuit including the three turns of loop wire and detector lead-in cable (DLC), was individually tested. To perform the test, the loop was disconnected from the detector card and one lead of the tester was attached to one of the DLC loop wire and the other to an earth ground. A leakage resistance, measured in this manner, of greater than 100 megohms is required for loop detector circuits per Caltrans standards.

During the inspection of the camera operations, it was found that the vehicle detection loops could not be automatically tuned at certain locations due to bad loops or for other reasons. When this occurred, it was not possible to test the camera operation. Failures of this type result in the camera unit not operating. There were four locations where problems with loops were encountered and camera testing could not be done as listed in Table 4-8. Problems with loop calibration were also experienced at the 10th Avenue and "A" Street location, but troubleshooting efforts were successful and the camera subsequently functioned properly.

4.4 FINDINGS AND RECOMMENDATIONS FOR CAMERA UNIT SETUPS

- Besides a few difficulties encountered during the inspection and testing of camera systems as described in the report, the camera equipment appeared to function properly and be well maintained. Appropriate camera unit settings were generally in place for all locations.

- The loop-to-loop pitch values, as input to the camera units at the 19 intersections, generally correspond very closely with the measured pitch dimensions. Small differences, up to one percent, were found between the camera unit and measured pitch values at selected locations. Any difference up to one percent should not be viewed as a

significant difference and is well within the tolerances for cutting loops and for vehicle detection as vehicles pass over loops.

At certain locations, it is difficult to determine with certainty what pitch measurement should be used for the camera unit setting due to the skewed installation of the vehicle detection loops and skewed intersection geometries. At these locations, it was necessary to make judgments regarding the expected paths of motor vehicles entering the intersection.

The pitch measurements will continue to be important when the vehicle detection loops are re-located, as they will be the basis for established vehicle speeds for the application of the minimum speed threshold, but not nearly as critical as under the current configurations.

The City should establish a written policy regarding pitch measurements and how pitch measurements are to be made where there are unusual or irregular loop configurations. For all cases, the policy should state that the shortest pitch dimension, where more than one pitch measurement may be applicable, should always be used for the camera unit setting (that is, in order that the measurement be in the favor of the motorist)

- At certain locations, two sets of loops are in place making it difficult to determine with certainty which set of loops are currently operational for the photo enforcement system. In the future, as built drawings should be maintained so that the operational loops can be readily identified. Abandoned loops should be intentionally cut on two sides so that it is clear that the loops have been abandoned as well as to eliminate any possibility of loop-to-loop crosstalk. Crosstalk between active loops and abandoned loops that have not been cut is possible and can result in unreliable loop detector performance.

- The delay time represents a “grace” period for motorists entering the intersection against a red traffic signal indication. The actual grace periods being applied the 19 photo-enforced intersections, except for the A Street/10th Street intersection, varies according to vehicle speed and the distance of the leading edge of the second loop from the stop line. In other words, the grace period is not consistent from intersection to intersection nor, for the most part, from vehicle to vehicle. The actual grace times may be determined by examining the tables developed by LM/ACS for each intersection and used to determine whether a citation should be issued for each photographed violation. From an examination of these tables, the actual grace periods applied in issuing citations vary from 0.25 seconds to 0.57 seconds.

  For the future when the vehicle detection loops have been re-located in accordance with the manufacturer’s recommended configuration and industry practice, the City needs to establish its policy for delay times at photo-enforced intersections. Delay times ranging between 0.3 seconds and 0.5 seconds are typically used.